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10/576,134	07/13/2007	Enrique V. Barrera	11321-P074W0US	5500
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WINSTEAD PC P.O. BOX 50784 DALLAS, TX 75201			CHOL PETER Y	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/576,134

Applicant(s)

BARRERA ET AL.

Examiner

PETER Y. CHOI

Art Unit

1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 September 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 41-73 is/are pending in the application.
- 4a) Of the above claim(s) 50-67 and 71-73 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 41-49 and 68-70 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 April 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statements(s) (PTO/SB08)
- Paper No(s)/Mail Date 11/21/07.
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group IV, claims 41-49, in the reply filed on September 9, 2009, is acknowledged. Claims 50-67 and 71-73 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Claim Objections

2. Claims 41-49 and 68-70 are objected to because of the following informalities: the claims appear to recite abbreviations for carbon nanotubes ("CNT") and singlewalled nanotubes ("SWNT"). The claims should not recite abbreviations for claimed structural limitations, as the abbreviations may be known in the art as representing various structures. Appropriate corrections are required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

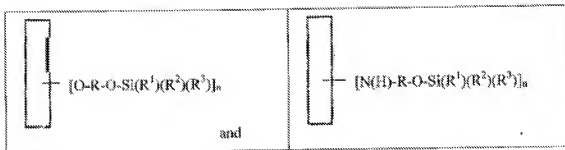
The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 68-70 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant

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art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Regarding claims 68-70, claim 68 recites that the CNTs have a general structural formula:



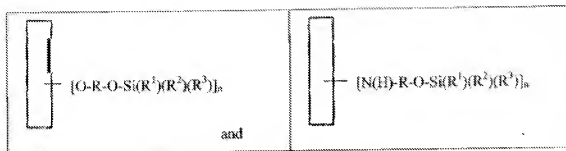
However, Applicants' specification as originally filed does not provide support for the specific structure claimed. Additionally, regarding claims 69 and 70, Applicants' specification as originally filed does not provide support for the claimed constituents.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 68-70 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 68-70, claim 68 recites that the CNTs have a general structural formula:



As shown, the general structural formulas each contain various constituents such as R, R¹, R², and R³, and the value n. It is unclear exactly what the scope of the formulas entails, as the claim does not specifically recite values associated with the constituents and n such that the scope of the claim is necessarily defined.

Claim Rejections - 35 USC § 102/103

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 41, 42, 45, and 47 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US Pub. No. 2005/0191490 to Ton-That.

Regarding claims 41, 42, 45, and 47, Ton-That teaches a composite material, comprising carbon nanotubes, a fiber reinforcement material, and a polymer, wherein the carbon nanotubes chemically bind the fiber reinforcement material with the polymer (paragraphs 0002-0022, 0025-0030, 0034-0042, 0050-0056, 0064, 0075, 0077, 0078). Additionally, it would have been obvious to one of ordinary skill in the reinforcing composite material art at the time the invention was made to form the reinforcing composite of the prior art, wherein the composite comprises glass fiber reinforcement material, as the prior art teaches the suitability of glass fibers in the reinforcing composite, and including glass fibers would have been obvious based on the desired tensile and flexural strength of composite suitable for the intended application.

Regarding claim 42, the carbon nanotubes are silane-functionalized (paragraph 0029).

Regarding claim 45, the fiber reinforcement comprises glass fibers (paragraphs 0077, 0078).

Regarding claim 47, the polymer is an epoxy (paragraphs 0002-0022, 0025-0030, 0034-0042, 0050-0056, 0064, 0075, 0077, 0078).

Claim Rejections - 35 USC § 103

9. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of “Single-Walled Carbon Nanotube-Polymer Composites: Strength and Weakness” to Ajayan.

Regarding claim 43, the prior art does not appear to teach that the carbon nanotubes are single-walled nanotubes. Since the prior art is silent as to the type of nanotubes, it would have been necessary and therefore obvious to look to the prior art for conventional nanotubes suitable

for use in composites. Ajayan provides this conventional teaching, showing that it was known in the composite art to form composites comprising carbon nanotube and epoxy composites, wherein the carbon nanotubes comprise single-walled nanotubes (Ajayan, pages 750-753). Ajayan teaches that various properties are known and attributed to carbon nanotubes, specifically single-walled carbon nanotubes. Additionally, Ajayan teaches that including single-walled carbon nanotubes in nanotube-epoxy composites increases the toughness of the composites by absorbing energy, strength and flexibility. It would have been obvious to one of ordinary skill in the composite art at the time the invention was made to form the composite of the prior art, wherein the carbon nanotubes comprise single-walled carbon nanotubes, as taught by Ajayan, motivated by the desire of forming a conventional nanotube-epoxy composite comprising nanotubes known in the art as predictably suitable for use in such composites to increase the toughness of the composites by absorbing energy, strength and flexibility.

10. Claims 44 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of USPN 6,270,897 to Flautt.

Regarding claims 44 and 46, the prior art does not appear to teach that the fiber reinforcement is silane-functionalized and that the glass fibers have been resized with an organosilane species. However, Flautt is classified in the same field in the art as Ton-That, and teaches a glass fiber reinforced composite material comprising glass fibers and an epoxy matrix (Flautt, column 1 line 7 to column 5 line 10, claims 1-14). Flautt teaches that sizing the glass fibers with an organosilane reduces interfilament abrasion, and improves compatibility of the fibers with the epoxy matrix material of the composite structure. It would have been obvious to

one of ordinary skill in the composite art at the time the invention was made to form the composite material of the prior art, wherein the glass fibers are sized with an organosilane, as taught by Flautt, as Flautt and Ton-That are classified in the same field in the art, and motivated by the desire of forming a conventional composite material wherein the interfilament abrasion of the glass fibers is reduced, the compatibility of the fibers with the epoxy matrix material is improved, and the physical properties of the composite material is enhanced.

11. Claims 48 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of USPN 3,312,569 to Philipps.

Regarding claims 48 and 49, the prior art does not appear to teach that the glass fibers are in a form of woven sheets, and that the woven sheets are stacked together with the silane-functionalized carbon nanotubes and the polymer between them. Since the prior art does not appear to teach in what form the glass fibers are employed, it would have been necessary and therefore obvious to look to the prior art for conventional forms of glass fibers in composites. Philipps is classified in the same field in the art as the prior art, and teaches that it was known in the reinforced composite art to form a glass fiber reinforced composite comprising glass fibers and an epoxy resin, wherein the glass fibers are in the form of woven mats (Philipps, column 1 line 14 to column 4 line 35, column 7 line 15 to column 8 line 68). It would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the glass fibers are in the form of woven sheets, as taught by Philipps, as Philipps and Ton-That are classified in the same field in the art, and motivated by the desire of forming a conventional reinforced composite comprising glass

fibers in forms known in the art as being predictably suitable for use in reinforced composites, based on the strength and flexural characteristics suitable for the intended application, as woven sheets will predictably comprise increased dimensional stability.

Regarding claim 49, although the prior art does not appear to specifically teach that the carbon nanotubes and the polymer are between the stacked sheets, it naturally flows from the prior art that the woven glass fibers are employed in an epoxy resin composite, and uniformly dispersing the constituents of the composite, such as the nanotubes, glass fibers, and epoxy resin, in the composite enhances the uniformity of the physical and chemical characteristics of the composite. Therefore, it would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the carbon nanotubes and polymer are between the woven sheets, motivated by the desire of forming a conventional reinforced composite comprising uniform physical and chemical characteristics, such that the composite comprises the desired strength, flexural characteristics, and dimensional stability suitable for the intended application.

12. Claims 68-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of “Chemical Functionalization of Carbon Nanotubes Through an Organosilane” to Velasco-Santos.

Regarding claims 68-70, the prior art does not appear to teach the specific formula of the silane-functionalized carbon nanotubes. Since the prior art is silent as to the specific formula of the silane-functionalized carbon nanotubes, it would have been necessary and therefore obvious to look to the prior art for conventional silane coupling agents. Velasco-Santos provides this

conventional teaching, showing that it was known in the reinforced composite art to form reinforced composites comprising a matrix and carbon nanotubes, wherein the nanotubes are functionalized with an organo-functionalized with a silane coupling agent chemically described as R-Si-R', wherein the R group is chosen to be reactive depending on the organic matrix used, and the R' group is generally trimethoxy (Velasco-Santos, pages 495-498). Velasco-Santos teaches that the group reacts readily with the hydroxyl group on the nanotube surface. Velasco-Santos teaches that attaching the organo-functional groups to the nanotubes improves their chemical compatibility with specific polymers. It would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the nanotubes are organo-functionalized as set forth in Velasco-Santos, motivated by the desire of forming a conventional reinforced composite with improved chemical compatibility when joining the nanotubes to the matrix. Additionally, as the prior art teaches that the R group is chosen to be reactive depending on the organic matrix used, it would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to choose a suitable R group to be reactive with an epoxy matrix, as the prior art suggests that it is within the level of ordinary skill to choose a suitable constituent to be reactive with an epoxy matrix, based on the desired compatibility of the materials and characteristics of the reinforced composites suitable for the intended application.

Regarding claim 69, the constituents are at least saturated aliphatic hydrocarbons or within the claimed groups (Velasco-Santos, pages 495-498).

Regarding claim 70, the prior art does not appear to specifically teach that R is an alkyl group having from 2 to 4 carbon atoms. However, as the prior art teaches that the R group is

chosen to be reactive depending on the organic matrix used, it would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to choose a suitable R group to be reactive with an epoxy matrix, such as an ethoxy group, as the prior art suggests that it is within the level of ordinary skill to choose a suitable constituent to be reactive with an epoxy matrix, based on the desired compatibility of the materials and characteristics of the reinforced composites suitable for the intended application.

13. Claims 68-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of Applicants' specification and "Chemical Functionalization of Carbon Nanotubes Through an Organosilane" to Velasco-Santos.

Regarding claims 68-70, the prior art appears to render obvious the claimed invention. Additionally, Applicants' specification teaches that prior art hydroxyl-functionalized carbon nanotubes include structures set forth in Figures 1 and 2 of Applicants' specification and set forth below:

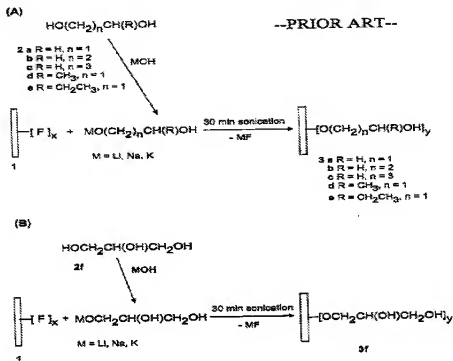


Fig. 1

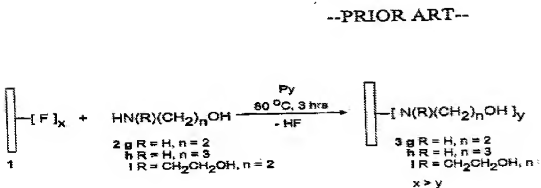


Fig. 2

Additionally, Velasco-Santos teaches that the silane coupling agent is chemically described as R-Si-R', wherein the R group is chosen to be reactive depending on the organic matrix used, and the R' group is generally trimethoxy (Velasco-Santos, pages 495-498). Additionally, Velasco-Santos teaches that the group reacts readily with the hydroxyl group on the nanotube surface. Velasco-Santos teaches that attaching the organo-functional groups to the nanotubes improves their chemical compatibility with specific polymers. It would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the nanotubes are organo-functionalized as set forth in Velasco-Santos and wherein the carbon nanotubes are hydroxyl functionalized as set forth in Applicants' specification, as Applicants' specification teaches that hydroxyl functionalized carbon nanotubes as set forth in Figures 1 and 2 of Applicants' specification were known, and motivated by the desire of forming a conventional reinforced composite with improved chemical compatibility when joining the nanotubes to the matrix. It should be noted that absent evidence to the contrary, the claimed structures would appear to result once the prior art combination is formed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PETER Y. CHOI whose telephone number is (571)272-6730. The examiner can normally be reached on Monday - Friday, 08:00 - 15:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on (571) 272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Peter Y Choi /PYC/
Examiner, Art Unit 1794

/D. Lawrence Tarazano/
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